



SEQUENCE LISTING

<110> Kim, Jinyun Francis
Beer, Steven V.

<120> HYPERSENSITIVE RESPONSE ELICITOR FROM ERWINIA AMYLOVORA
AND ITS USE

<130> 19603/3286

<140> 09/596, 958

<141> 2000-06-20

<150> 09/120, 927

<151> 1998-07-22

<150> 60/055, 108

<151> 1997-08-06

<160> 10

<170> PatentIn Ver. 2.1

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<212> DNA

<213> Erwinia amylovora

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cggcaaacca ttgagcaaat ggctcaatta ttggcggAAC tgtaaagtc actgctatcg 180
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TECH CENTER 1600/2900

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Ala Leu Gly Gln Gln Pro Ile Asp Arg Gln Thr Ile Glu Gln Met Ala
35 40 45

Gln Leu Leu Ala Glu Leu Lys Ser Leu Leu Ser Pro Gln Ser Gly
50 55 60

Asn Ala Ala Thr Gly Ala Gly Gly Asn Asp Gln Thr Thr Gly Val Gly
65 70 75 80

Asn Ala Gly Gly Leu Asn Gly Arg Lys Gly Thr Ala Gly Thr Thr Pro
85 90 95

Gln Ser Asp Ser Gln Asn Met Leu Ser Glu Met Gly Asn Asn Gly Leu
100 105 110

Asp Gln Ala Ile Thr Pro Asp Gly Gln Gly Gly Gln Ile Gly Asp
115 120 125

Asn Pro Leu Leu Lys Ala Met Leu Lys Leu Ile Ala Arg Met Met Asp
130 135 140

Gly Gln Ser Asp Gln Phe Gly Gln Pro Gly Thr Gly Asn Asn Ser Ala
145 150 155 160

Ser Ser Gly Thr Ser Ser Ser Gly Gly Ser Pro Phe Asn Asp Leu Ser
165 170 175

Gly Gly Lys Ala Pro Ser Gly Asn Ser Pro Ser Gly Asn Tyr Ser Pro
180 185 190

Val	Ser	Thr	Phe	Ser	Pro	Pro	Ser	Thr	Pro	Thr	Ser	Pro
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Leu	Asp	Phe	Pro	Ser	Ser	Pro	Thr	Lys	Ala	Ala	Gly	Gly
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Val	Thr	Asp	His	Pro	Asp	Pro	Val	Gly	Ser	Ala	Gly	Ile
225					230					235		240
Asn	Ser	Val	Ala	Phe	Thr	Ser	Ala	Gly	Ala	Asn	Gln	Thr
					245					250		255
Asp	Thr	Ile	Thr	Val	Lys	Ala	Gly	Gln	Val	Phe	Asp	Gly
					260					265		270
Thr	Phe	Thr	Ala	Gly	Ser	Glu	Leu	Gly	Asp	Gly	Gly	Gln
					275					280		285
Gln	Lys	Pro	Leu	Phe	Ile	Leu	Glu	Asp	Gly	Ala	Ser	Leu
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Thr	Met	Gly	Asp	Asp	Gly	Ala	Asp	Gly	Ile	His	Leu	Tyr
					305					310		315
Lys	Ile	Asp	Asn	Leu	His	Val	Thr	Asn	Val	Gly	Glu	Asp
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Val	Lys	Pro	Asn	Ser	Ala	Gly	Lys	Ser	His	Val	Glu	Ile
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Ser	Ser	Phe	Glu	His	Ala	Ser	Asp	Lys	Ile	Leu	Gln	Leu
					355					360		365
Thr	Asn	Leu	Ser	Val	Asp	Asn	Val	Lys	Ala	Lys	Asp	Phe
					370					375		380
Val	Arg	Thr	Asn	Gly	Gly	Gln	Gln	Gly	Asn	Trp	Asp	Leu
					385					390		395
His	Ile	Ser	Ala	Glu	Asp	Gly	Lys	Phe	Ser	Phe	Val	Lys
					405					410		415
Glu	Gly	Leu	Asn	Val	Asn	Thr	Ser	Asp	Ile	Ser	Leu	Gly
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Pro Thr Ala Val Pro Val Lys Gly Ser Tyr Asp Gly Gly Met Lys Arg
35 40 45

Phe Glu Arg Glu Pro Lys Val Cys Lys Gly Gln Asp Glu Thr Gly Glu
50 55 60

Lys Asp Ala Met Phe Ile Leu Glu Asn Gly Ala Thr Leu Ser Asn Val
65 70 75 80

Ile Ile Gly Ala Ser Gln Ala Glu Gly Val His Cys Lys Gly Thr Cys
85 90 95

Thr Leu Asn Asn Val Trp Trp Ala Asp Val Cys Glu Asp Ala Val Thr
100 105 110

Leu Lys Gln Thr Ser Gly Thr Ser Tyr Ile Asn Gly Gly Ala Phe
115 120 125

His Ala Ser Asp Lys Ile Ile Gln Phe Asn Gly Arg Gly Thr Val His
130 135 140

Val	Lys	Asp	Phe	Tyr	Ala	Glu	Asp	Tyr	Gly	Lys	Leu	Ser	Arg	Ser	Cys
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Gly	Asn	Cys	Lys	Asp	Asn	Gly	Gly	Pro	Arg	Asn	Val	Ile	Val	Glu	Asn
					165				170					175	
Ser	Val	Ala	Val	Asp	Gly	Gly	Val	Leu	Cys	Gly	Ile	Asn	Thr	Asn	Tyr
					180			185					190		
Gly	Asp	Thr	Cys	Lys	Val	Ile	Asn	Ser	Cys	Gln	Asp	Lys	Gly	Lys	Tyr
					195			200				205			
Cys	Asp	Arg	Tyr	Glu	Gly	Asn	Ser	Ser	Gly	Lys	Glu	Pro	Thr	Lys	Ile
					210			215				220			
Gly	Ser	Gly	Pro	Asp	Gly	Lys	Tyr	Cys	Thr	Val	Thr	Gly	Ser	Thr	Thr
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Ser	Cys														

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					20					25				30	
Thr	Ala	Ile	Pro	Val	Arg	Lys	Gly	Asp	Lys	Tyr	Asn	Gly	Gly	Met	Lys
					35			40				45			
Arg	Phe	Val	Arg	Asn	Pro	Thr	Thr	Cys	Lys	Asp	Gln	Tyr	Glu	Thr	Gly
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Glu	Lys	Asp	Ala	Ser	Phe	Ile	Leu	Glu	Asp	Gly	Ala	Thr	Leu	Ser	Asn
					65			70			75			80	
Val	Ile	Ile	Asp	Arg	Ser	Ser	Gly	Glu	Gly	Val	His	Cys	Lys	Gly	Thr
					85				90				95		
Cys	Thr	Leu	Asn	Asn	Val	Trp	Trp	Ala	Asp	Val	Cys	Glu	Asp	Ala	Ala
					100				105				110		

Thr Phe Lys Gln Lys Ser Gly Thr Ser Thr Ile Asn Gly Gly Ala
115 120 125

Phe Ser Ala Gln Asp Lys Val Leu Gln Phe Asn Gly Arg Gly Thr Leu
130 135 140

Asn Val Asn Asp Phe Tyr Val Gln Asp Tyr Gly Lys Leu Val Arg Asn
145 150 155 160

Cys Gly Asn Cys Glu Gly Asn Gly Gly Pro Arg Asn Ile Asn Ile Lys
165 170 175

Gly Val Val Ala Lys Asn Gly Gly Glu Leu Cys Gly Val Asn His Asn
180 185 190

Tyr Gly Asp Val Cys Thr Ile Thr Asp Ser Cys Gln Asn Lys Gly Lys
195 200 205

Ser Cys Gln Ala Tyr Thr Gly Asn Asp Gln Lys Lys Glu Pro Pro Lys
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Phe Gly Pro Ala Gly Asp Asn Gly Lys Ser Cys Leu Val Lys Ser Leu
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Arg Thr Asn Cys

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<213> Fusarium solani f. sp. pisi

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Gly Lys Trp Ala Lys Tyr Asp Arg Gly Ser Gly Ala Cys Lys Gly Gln
35 40 45

Asn Glu Gly Gly Asp Lys Asp Ala Val Phe Leu Leu His Glu Gly Ala
50 55 60

Thr Leu Lys Asn Val Ile Ile Gly Lys Asp Gln Ser Glu Gly Val His

65 70 75 80

Cys Lys Gly His Cys Thr Leu Glu Phe Val Trp Phe Glu Asp Val Cys
85 90 95

Glu Asp Ala Ile Ser Ile Ala Gly Lys Glu Ser Trp Ile Ile Gly Gly
100 105 110

Gly Ala Tyr His Ala Ser Asp Lys Val Val Gln His Asn Gly Cys Gly
115 120 125

Thr Val Asn Ile Ile Asn Phe Tyr Val Glu Asp Tyr Gly Lys Leu Tyr
130 135 140

Arg Ser Cys Gly Asn Cys Ser Lys Gln Cys Lys Arg Asn Val Tyr Ile
145 150 155 160

Glu Gly Val Thr Ala Lys Asn Gly Gly Glu Leu Ala Gly Ile Asn Ala
165 170 175

Asn Tyr Gly Asp Thr Ala Thr Leu Lys Asn Val Cys Ala Asp Ala Lys
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Gln Lys Cys Thr Met Tyr Asn Gly Cys Ala Gly Gly Cys Glu Pro Lys
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Lys Ile Gly Ala Cys Pro Ala
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<213> Fusarium solani f. sp. pisi

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Ala Gly Trp Val Arg Tyr Asp Arg Gly Val Lys Cys Ser Gly Gln Ala
35 40 45

Glu Gly Gly Ser Lys Asp Ala Val Phe Ile Leu Glu Glu Gly Ala Thr
50 55 60

Leu	Arg	Asn	Val	Ile	Ile	Gly	Ala	Asn	Gln	Arg	Glu	Gly	Ile	His	Cys
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					85				90					95	
Asp	Ala	Ile	Ser	Ile	Leu	Gly	Ser	Gly	Thr	Ala	Asn	Ile	Ile	Gly	Gly
					100				105				110		
Gly	Ala	Tyr	His	Ala	Ser	Asp	Lys	Val	Ile	Gln	His	Asn	Gly	Cys	Gly
					115				120				125		
His	Val	Asn	Ile	Val	Asn	Phe	Tyr	Ala	Asn	Asp	Tyr	Gly	Lys	Val	Tyr
					130				135				140		
Arg	Ser	Cys	Gly	Asn	Cys	Lys	Gly	Asn	Thr	Asn	Cys	Lys	Arg	Ser	Val
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His	Met	Glu	Gly	Thr	Thr	Ala	Val	Lys	Gly	Gly	Glu	Leu	Ile	Gly	Ile
					165				170				175		
Asn	Thr	Asn	Tyr	Gly	Asp	Lys	Ala	Thr	Tyr	Ser	Asn	Asn	Cys	Tyr	Pro
					180				185				190		
Lys	Thr	Gln	Cys	Gln	Gly	Tyr	Lys	Gly	Cys	Asp	Lys	Ser	Lys	Gly	Glu
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Phe	Gln	Ala	Gln	Ala	Asp	Asp	Thr	Met	Leu	Met	Leu	Leu	Lys	Lys	Asp
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Asn	Ala	Thr	Tyr	Leu	Ser	Trp	Ser	Thr	Asp	Ala	Gly	Asn	Val	Val	Arg
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Gln	Asp	Val	Tyr	Arg	Ser	Thr	Ser	Ser	Ala	Gln	Ala	Gly	Ser	Glu	Lys
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Ile	Ala	Glu	Leu	Asn	Ser	Ser	Asp	Arg	Thr	Phe	Thr	Asp	Leu	Thr	Ala
65															80
Asn	Pro	Gln	Ser	Asp	Tyr	Trp	Tyr	Trp	Val	Asp	Thr	Val	Ser	Gly	Asn
					85				90						95
Asn	Ser	Val	Leu	Lys	Ser	Asn	Ala	Ala	Ser	Thr	Ala	Pro	Ala	Pro	Leu
					100				105						110
Arg	Ala	Ala	Pro	Leu	Lys	Ala	Ala	Ser	Pro	Glu	Cys	Lys	Ala	Gly	Ala
						115			120						125
Val	Ile	Lys	Asp	Lys	Thr	Val	Asp	Cys	Gly	Gly	Ile	Thr	Leu	Gly	Leu
						130			135						140
Ser	Cys	Ser	Gly	Asp	Ser	Asp	Lys	Gln	Pro	Pro	Val	Ile	Thr	Leu	Glu
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Asn	Ala	Thr	Ile	Lys	Asn	Leu	Arg	Ile	Ser	Glu	Lys	Gly	Gly	Ser	Asp
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Gly	Ile	His	Cys	Lys	Ser	Gly	Asn	Cys	Arg	Ile	Glu	Asn	Val	Ile	Trp
							180			185					190
Glu	Asp	Ile	Cys	Glu	Asp	Ala	Ala	Thr	Asn	Leu	Gly	Lys	Thr	Met	Thr
							195			200					205
Ile	Val	Gly	Gly	Val	Ala	His	Asn	Thr	Thr	Asn	Gly	Pro	Gly	Gly	Lys
							210			215					220
Pro	Asp	Lys	Val	Leu	Gln	Gln	Asn	Ala	Lys	Asn	Ser	His	Thr	Ile	Val
							225			230					240
Gln	Gly	Lys	Phe	Thr	Leu	Thr	Gly	Gln	His	Gly	Lys	Leu	Trp	Arg	Ser
							245			250					255
Cys	Gly	Asp	Cys	Thr	Asn	Asn	Gly	Gly	Pro	Arg	Asn	Leu	Thr	Ile	Ile
							260			265					270
Ser	Ala	Thr	Val	Asn	Gly	Thr	Ile	Asp	Ser	Ile	Ala	Gly	Val	Asn	Arg
							275			280					285
Asn	Phe	Gly	Asp	Val	Ala	Glu	Ile	Arg	Asp	Leu	Arg	Ile	Lys	Gly	Tyr
							290			295					300
Lys	Glu	Gly	Lys	Pro	Pro	Val	Cys	Glu	Glu	Phe	Asn	Gly	Val	Glu	Lys
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Cys Lys Val Ser Arg Ser Asn Val Lys Pro Leu
340 345

<210> 9
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Asn Ala Thr Tyr Leu Ser Trp Ser Thr Asp Ala Gly Asn Val Val Arg
35 40 45

Gln Asp Val Tyr Arg Ser Thr Asn Asn Ala Gln Ala Gly Ser Glu Lys
50 55 60

Ile Ala Glu Leu Asn Ser Thr Asp Arg Thr Phe Thr Asp Leu Thr Ala
65 70 75 80

Asn Pro Lys Ser Asp Tyr Trp Tyr Trp Val Asp Thr Val Ser Ser Asn
85 90 95

Asn Asn Val Gln Lys Ser Asn Ala Ala Gln Thr Ala Pro Ala Pro Leu
100 105 110

Arg Ala Ala Pro Leu Lys Ala Ala Ser Ser Glu Cys Lys Ala Gly Ala
115 120 125

Val Ile Lys Asp Lys Thr Val Asp Cys Gly Gly Ile Thr Leu Gly Leu
130 135 140

Ser Cys Thr Gly Asp Ser Asp Lys Gln Pro Pro Val Ile Thr Leu Glu
145 150 155 160

Asn Ala Thr Ile Lys Asn Leu Arg Ile Ser Glu Lys Gly Gly Ser Asp
165 170 175

Gly Ile His Cys Lys Ser Gly Asn Cys Arg Ile Glu Asn Val Ile Trp

180	185	190
Glu Asp Val Cys Glu Asp Ala Ala Thr Asn Leu Gly Lys Thr Met Thr		
195	200	205
Ile Val Gly Gly Val Ala His Asn Thr Thr Asn Gly Pro Gly Gly Lys		
210	215	220
Pro Asp Lys Val Leu Gln Gln Asn Ala Lys Asn Ser His Thr Ile Val		
225	230	235
Gln Gly Asn Phe Thr Leu Thr Gly Gln His Gly Lys Leu Trp Arg Ser		
245	250	255
Cys Gly Asp Cys Thr Asn Asn Gly Gly Pro Arg Asn Leu Thr Ile Ile		
260	265	270
Ser Ala Thr Val Asn Gly Thr Ile Asp Ser Ile Ala Gly Val Asn Arg		
275	280	285
Asn Phe Gly Asp Val Ala Glu Ile Arg Asp Leu Arg Ile Lys Asn Tyr		
290	295	300
Lys Ala Gly Asn Pro Lys Ile Cys Glu Glu Phe Lys Gly Ile Glu Lys		
305	310	315
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Cys Lys Val Ser Arg Ser Asn Val Lys Ala Leu		
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<223> Xaa at position 123 is Leu, Phe, His, or Gln

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<223> Xaa at position 130 is Ser, His, Asn, or Thr

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<223> Xaa at position 230 is Pro, Gly, Lys, or Trp

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Lys Gly Xaa Xaa Tyr Asp Gly Xaa Xaa Xaa Xaa Phe Xaa Arg Xaa Xaa
20 25 30

Xaa Xaa Cys Xaa Gly Gln Xaa Glu Xaa Gly Asp Lys Asp Ala Xaa Phe

35

40

45

Ile Leu Glu Glu Gly Ala Thr Leu Lys Asn Val Xaa Ile Ile Gly Xaa
 50 55 60

Xaa Xaa Xaa Glu Gly Ile His Cys Lys Xaa Gly Xaa Cys Xaa Ile Glu
 65 70 75 80

Asn Val Trp Trp Glu Asp Val Cys Glu Asp Ala Ile Xaa Xaa Xaa Xaa
 85 90 95

Xaa Thr Met Xaa Xaa Xaa Ser Gly Xaa Xaa Xaa Ile Xaa Gly Gly Gly
 100 105 110

Ala Xaa His Ala Ser Asp Lys Val Leu Gln Xaa Asn Gly Xaa Gly Xaa
 115 120 125

Xaa Xaa Ile Val Xaa Xaa Xaa Xaa Phe Tyr Xaa Xaa Asp Tyr Gly Lys
 130 135 140

Leu Xaa Arg Ser Cys Gly Asn Cys Xaa Xaa Asn Xaa Gly Xaa Xaa Arg
 145 150 155 160

Xaa Val Xaa Ile Xaa Xaa Xaa Val Ala Xaa Xaa Gly Xaa Xaa Xaa Xaa
 165 170 175

Xaa Xaa Gly Glu Leu Xaa Gly Xaa Asn Xaa Asn Tyr Gly Asp Val Ala
 180 185 190

Xaa Ile Xaa Xaa Xaa Cys Xaa Xaa Xaa Xaa Xaa Xaa Lys Xaa Xaa
 195 200 205

Xaa Cys Xaa Xaa Tyr Xaa Gly Xaa Glu Xaa Gly Lys Xaa Glu Xaa Xaa
 210 215 220

Lys Xaa Gly Xaa Xaa Xaa Asp
 225 230